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**Endogamy, consanguinity and the health implications of changing marital choices
in the UK Pakistani community**

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Running heading: Health implications of changing marital choice

Endogamy, consanguinity and the health implications of changing marital choices in the UK Pakistani community

Summary

The biraderi (brotherhood) is a long-established, widely prevalent dimension of social stratification in Pakistani communities worldwide. Alongside consanguinity, it offers a route for cementing social solidarities and so has strong sociobiological significance. A detailed breakdown of *biraderi* affiliation among participants in an ongoing birth cohort study in the Northern English city of Bradford is presented. There is historical resilience of intra-*biraderi* marriage, but with a secular decline in prevalence across all *biraderi* and considerable reductions in some. While a majority of marriages in all *biraderi* are consanguineous the prevalence varies, ranging from over 80% to under 60%. In consanguineous unions, first cousin marriages account for more than 50% in five of the 15 *biraderi* and >40% in six others. Within-*biraderi* marriage and consanguinity enhance genetic stratification, thereby increasing rates of genomic homozygosity and the increased expression of recessive genetic disorders. The trends we report constitute putative signals of generational change in the marital choices in this community.

Endogamy, consanguinity and the health implications of changing marital choices in the UK Pakistani community

Introduction

Population based surveys have shown that around one in seven of the world's population, or over 1,100 million people, live in countries where 20% to more than 50% of marriages are contracted between couples related as second cousins or closer, with first cousin marriage the most common form of consanguineous union. The main regions in which consanguinity is favoured are North and Sub-Saharan Africa, the Middle East, Central and South Asia, and intra-familial marriage continues to be practised among the many emigrant communities from these regions now resident in Europe, the Americas and Oceania (Bittles et al. 1991; Bittles & Black 2010). A large majority of these countries have a younger age group profile and a higher birth rate than world averages.

On average, first cousin offspring experience an additional 3.7% mortality from approximately 28 weeks gestation to 10-12 years of age. In terms of birth defects, they have an additional median risk of 3.3% (i.e. a total additional risk of ~7% morbidity or mortality) (Bittles 2012, 227). This risk arises from the increased expression of deleterious recessive genes in the offspring of consanguineous unions. In terms of the Global Burden of Disease, worldwide declines in infant mortality, due to reductions in infectious diseases and nutritional disorders (UNICEF et al. 2014) can be predicted to lead to a proportional increase in morbidity caused by recessive disorders and other forms of non-communicable disease (Institute for Health Metrics and Evaluation 2010).

In addition to consanguinity, in many communities marriage is also contracted within restricted sub-communities, e.g. between partners preferentially (and often obligatorily) drawn from the same clan, tribe or caste and therefore lineal descendants of a common male ancestor. This practice is important genetically, since endogamous subdivisions result in significantly greater intra-community genetic homogeneity and therefore an increased proportion of homozygotes in the population as a whole, as demonstrated in the final phase of the 1000 Genomes Project (Gazal et al. 2015). The resultant increased homozygous expression of recessive genes has often mistakenly been ascribed solely to consanguineous marriage (Bittles 2012:82).

Preference for consanguineous marriage and widespread endogamy are features of the socio-cultural context within which medical genetic services must work (Bittles 2001; WHO 2006). In terms of the epidemiology of recessive disorders and the community health implication of planning services to respond to them, in health promotion, health education services, and in planning for the care of the morbidity that results, it is important to understand the changing picture of consanguinity and endogamy (Bittles 2008).

Born in Bradford is a multi-ethnic longitudinal birth cohort study based in the North of England (Raynor et al. 2008). 12,453 pregnant women were recruited between 2007 and 2011 and they delivered 13,776 pregnancies. Questionnaire data were available for 11,396 babies. Of these, 5,127 babies were of Pakistani origin with 59% of their mothers related to their partner as second cousins or closer (equivalent to a coefficient of inbreeding $F \geq 0.0156$) (Wright et al. 2012; Bittles

2001). An increased risk for congenital anomalies from 2.6% in the progeny of unrelated couples to 6.2% in first cousin relationships was reported, but also a surprisingly high risk (5.3%) in the children of more distantly related parents (Sheridan et al. 2013). This similarity in risk at different levels of consanguinity indicates the need to investigate possible causative associations between consanguineous marriage and genetic disorders in the Bradford Pakistani community from a population stratification perspective. A key element in population stratification in Pakistani communities worldwide is the substructure of *biraderi* (literally brotherhood), traditional male lineages that primarily denote socio-occupational status (Bittles & Small, 2015).

The present paper considers changes occurring in the patterns of marriages contracted within *biraderi* and additionally examines if individual *biraderi* have different patterns of consanguinity (Corry 2014). Longstanding consanguinity and *biraderi* endogamy could both play a part in the elevation of coefficients of relationship to levels higher than expected from the parental relationship alone (Bittles 2013). Thus a community history characterised by continuity of intra-*biraderi* marriage would be expected to enhance genetic stratification within the UK Pakistani population, while any erosion of *biraderi* preferences in marriage choice would lead to a reduction.

Marriage within the *biraderi* complements consanguinity in cementing social solidarities. Taken together they constitute ‘a distinct sociobiological structure’ where consanguinity is both an intra-familial and intra-community practice (Jabeen & Malik 2014). The layers of significance can be considered genetically but, as marriage choice is also a social phenomenon, the role of *biraderi* also needs to be considered from sociological and anthropological perspectives.

A traditional role of the *biraderi* has been as a mutual social support system, e.g. assisting with employment or accommodation (Seebohm et al. 2005) and as a welfare agency arranging loans, including financial help to members and their families in ill-health (Meulemans et al. 2003). In providing these sorts of support *biraderi* may act as a buffer, building social capital to offset the adverse impact of deprivation (Uphoff et al. 2013). *Biraderi* can also have a ‘political’ role. As in Pakistan (Hooper & Hamid 2003; Mohmand 2011), support for *biraderi*-endorsed candidates in elections has been an expectation within some sections of the UK Pakistani community, impacting on candidate selection and voting patterns (Michael 2004; Baston 2012).

Assistance with marriage arrangements, including contributions towards the dowries of poorer families within the membership (Zaman 2008), is an especially important facet of *biraderi* activity. Within the UK Pakistani community the *biraderi* act as significant intermediaries in transnational marriage arrangements (Shaw 2000, 2009). Indeed, it has been proposed that besides family obligations and cultural preferences, a major reason for the continuation of transnational marriages between the UK and Pakistan is the requirement to marry within the *biraderi*. If there is a shortage of potential UK-resident partners from whom to choose, families will look to Pakistan for partners (Samad & Eade 2002). Assistance provided in facilitating transnational marriages thus serves to maintain and strengthen links with the international network of members of the *biraderi* resident in different countries, especially Pakistan (Cameron 2006). Shaw (2014) summarized this role as ‘pivotal for many families in maintaining socio-economic and emotional connections between transnationally divided kin’.

The aims of this article are to:

- Present detailed data on *biraderi* affiliation reported by women recruited to the Born in Bradford study for themselves, their partners, their parents, their partner's parents and their maternal and paternal grandparents.
- Determine whether there are differences in the prevalence and types of consanguineous marriage between *biraderi*.

Subjects and Methods

Data on *biraderi* membership were collected as part of the Born in Bradford mother's baseline questionnaire (Raynor et al. 2008). This was an interviewer-administered questionnaire undertaken in the language chosen by the respondent at the hospital where women, who were between 26 and 28 weeks of pregnancy, were receiving antenatal care. Of the cohort total of 13,776 pregnancies 11,396 included the mothers completing a baseline questionnaire, of these 4,629 mothers of Pakistani heritage supplied data about *biraderi* (Wright et al. 2013). These women were asked to identify their own *biraderi*, that of their partners, their own parents and the parents of their partners. They were also asked to identify their grandparents' *biraderi*. The response to this question was a free text option. Some women indicated that they did not know their *biraderi* affiliations or did not wish to answer this question; this response ranged from 10.5% in relation to their own *biraderi* to 14.6% for the question about their maternal grandmothers.

Other respondents identified themselves by *biraderi* sub-group. Where possible these sub-groups were linked to the main *biraderi* groupings identified by respondents. A number of the reported *biraderi* sub-groups could not be so identified because the category under which they should have been entered was unclear. These were women who were clear about their *biraderi* membership and about that of their partners and parents, but the *biraderi* they identified was not one of the main groupings identified by others. These 'Non-grouped' responses constituted between 9.9% and 11.1% of the total in the different generations.

Missing data are likely to primarily reflect the demands of completing the complex baseline questionnaire, where questions about *biraderi* were only a small section of an extensive interview that had to be completed within a limited time-period.

At the baseline interview women were asked if they were related to the father of their baby other than by marriage. If the response was in the affirmative, details of the relationship were ascertained and the mother was also asked whether their own parents and the baby's father's parents were related by blood. In addition, a detailed family tree was drawn up by the trained interviewer. It is worth noting that in highly consanguineous populations, such as the UK Pakistani community, genomic studies have shown that even couples who declare themselves to be unrelated are homozygous at a proportion of gene loci, due to consanguineous unions in ancestral generations (Jalkh et al. 2015).

Ethical approval for the Born in Bradford baseline data collection was given by the Bradford local NHS Research Ethics Committee.

Results

The numbers and frequencies of group membership for each *biraderi* were calculated, including the percentage of cases where the mother and father were from the same *biraderi* (Table 1). Intra-*biraderi* marriage is the norm for all groups of parents of Pakistani origin in the Born in Bradford Study. The lowest percentage of intra-*biraderi* marriage in the present generation of mothers was in the Quereshi (61.0%), with slightly higher percentages in the Malik and Sheikh (61.4% and 63.2% respectively). In the other *biraderi* the equivalent percentages were >70% in the Kashmiri (74.9%) and Mughal (79.0%); $\geq 80\%$ in the Syed and Qasabi (both 80.0%), Rajput (80.5%), Awaan (81.8%), 'Non-grouped' (82.0%), and Choudhry (83.3%); and >90% in the Gujjar (91.1%), Pathan (91.4%), Jatt (91.7%) and Bain (93.0%).

Table 1 about here

Despite these high levels of *biraderi* endogamy the current levels of intra-*biraderi* marriage indicate a significant downward shift from the previous parental and grandparental generations. Table 2 presents the prevalence of inter-*biraderi* marriages between mothers' parents and fathers' parents, and Table 3 shows the intra-*biraderi* marriage prevalence in the prior generation in the maternal line, i.e. the mothers' grandparents.

Among the maternal grandparents of the Born in Bradford babies the lowest rate of intra-*biraderi* marriage was in the Sheikh *biraderi* (76.3%), with the Quereshi and Kashmiri both >80% intra-*biraderi*, and the remaining 12 *biraderi* >90% endogamous. In the great-grandparental generation the lowest level of intra-*biraderi* marriage was once again in the Sheikh, but at 94.6%, and with 100% of Chaudhry, Syed and Qasabi marriages intra-*biraderi*.

Chi square tests were undertaken to determine if the proportion of intra-*biraderi* marriages over the different generational profiles had changed on the maternal side. The results of this analysis, conducted by examining marriage patterns across all *biraderi* groups, indicated that there was a highly significant difference in the prevalence of intra-*biraderi* marriages by generation ($p < 0.001$).

Tables 2, 3 about here

Table 4 includes only those parents of Born in Bradford babies who are members of the same *biraderi*. The percentage of women in each *biraderi* who reported they also were in consanguineous unions ($F \geq 0.0156$) is presented. The highest prevalence of consanguinity was found in the Awaan (82.5%), Quereshi (82.0%) and Gujjar (80.5%). Seven other *biraderi* had rates of consanguinity between 70% and 80%, two between 60% and 70% consanguinity, and the lowest prevalence of consanguinity was in the Sheikh (55.6%) and Syed (58.3%).

First cousin marriage predominated but, as in Tables 1-3, differences were apparent across *biraderi*. The lowest rates of first cousin marriage were reported in the Kashmiri (32.3%), Sheikh (33.3%) and Bain (37.8%), and the highest was in the Awaan where 60.3% of intra-*biraderi* marriages were between first cousins. As a result, the mean coefficient of inbreeding across all *biraderi* was $\alpha = 0.0297$, ranging from $\alpha = 0.0233$ in the Kashmiri *biraderi* to $\alpha =$

0.0392) in the Awaan. The ‘Non-grouped’ category is excluded from Tables 4 and 5 since it is unclear whether all were members of the same *biraderi*.

Table 4 about here

Table 5 summarizes the different *biraderi*-specific relationships between endogamy, consanguinity in general and first cousin unions observed in the present generation. A number of *biraderi* have a high prevalence of intra-*biraderi* marriage, high consanguinity and high first cousin marriage, e.g. the Gujjar, whereas some, such as the Sheikh, were low on all three measures. Others, e.g. the Jatt and Pathan, had high levels of within-*biraderi* marriage but a comparatively low prevalence of consanguinity. Not surprisingly, there was greater consistency between overall consanguinity and the percentages of first cousin marriage.

Table 5 about here

Discussion

Providing a summary of cross-generational *biraderi* membership illuminates both the resilience of the *biraderi* as a social institution and variation in adherence to *biraderi* membership in the choice of marriage partners. While there has been a community-wide decline in intra-*biraderi* marriage through time, with a particularly marked decline in some, such as the Sheikh, its overall significance within the Bradford Pakistani community remains high. A large majority of marriages are still contracted within *biraderi* in the current parental generation, reaching 91.7% in the Jatt (which has the largest membership in the Born in Bradford cohort). There has, however, been a significant overall decline, most notably in the present parental generation.

If this trend continues it would seem probable that a decline in intra-*biraderi* marriage in Bradford would be accompanied, or even exceeded, by a reduction in the prevalence of consanguineous marriages within the Pakistani community. A reduction in consanguinity also would be accelerated by smaller family sizes, resulting in fewer marriageable cousins (Bittles 2012). To some extent any such local shortage of potential marriage partners could be overcome via transnational unions. However, UK immigration rules changed in July 2012 (after recruitment to the Born in Bradford cohort was complete), and new income thresholds that a UK spouse has to meet before an overseas marriage partner can be admitted to the country are likely to have a significant impact on transnational marriage. Changes to immigration laws can create rapid shifts in an area that is otherwise principally characterised by generational change (Grjibovski et al. 2009; de Koning et al. 2014). From a genetic perspective, the net effect of reductions in family size, together with restrictions on transnational marriage, predictably would be a decline in the prevalence of specific recessive disorders in future generations (Bittles 2008; Campbell et al. 2009; Bittles & Black 2010; Hamamy et al. 2011; Bittles 2012; Barakat & Basten 2014).

There is some evidence of positive social effects of consanguineous marriage for women and that these effects are in domains which can impact on their own and their families’ health (Bhopal et al. 2014). Effects of this nature need to be considered alongside adverse health outcomes associated with consanguinity to achieve a balanced picture of the health outcomes of changing marriage patterns. Likewise the continuing significance of *biraderi* in the UK Pakistani community in economic, political, cultural and emotional domains are also likely to have

relevance for health as manifestations of a community-specific form of social capital (Uphoff et al. 2013). A reduction in intra-*biraderi* marriage therefore may result in a decline in its salience in these areas.

As specific rare recessive disorders may be unique to individual *biraderi* (Bittles 2009, 2012), knowledge of variations in marriage practice could assist in planning genetic counselling, health promotion and health education programmes. More accurately targeted interventions are likely to have enhanced efficacy, not least through improved acceptability within the Pakistani community (Darr et al. 2013; Darr et al. 2015). More nuanced knowledge could also help to defuse the emotional and often ill-informed ‘consanguinity debate’, based on generalised assumptions that have dogged health care within the UK Pakistani population since the 1980s. These assumptions and debates have also had a negative recent resonance in many other countries and communities (Bhopal et al. 2014; de Koning et al. 2014; Liversage & Rytter 2015).

Questions as to the stability of *biraderi* affiliation through time, why reductions in marriage within *biraderi* have occurred and why there are continuing and expanding differences between *biraderi* need to be investigated using qualitative methods. A comparative study of the geographical, social, educational and occupational profiles of each *biraderi* would provide valuable information on the contemporary characteristics of these long-standing but changing social groupings. Given the difference between rates of intra-*biraderi* marriage and consanguinity, for example, in the Jatt and Pathan, a key aim would be to explore if knowledge of one’s past health in terms of congenital anomalies or other health issues could be shaping community choices about consanguinity within intra-*biraderi* marriage. In overall terms, recognising the complexity of marriage choice allows us to question facile assumptions that a preferred marital practice in one community will necessarily be shaped in the same way and to the same extent in others.

Several possible limitations apply to the findings of the present study. 1. Bradford’s Pakistani origin community comes predominantly from Azad Kashmir province, with a considerable proportion from its rural Mirpur district. Different marriage patterns may exist in Pakistani communities that originated from other provinces (Shaw 2014; Bittles & Small 2015). 2. *Biraderi* membership and consanguinity status were identified by maternal self-report, where respondents were identifying relationships on behalf of generations of their own relatives and those of their partners. Thus there is a possibility that the attributions supplied were inaccurate. It might be that social desirability biases attribute greater homogeneity to *biraderi* membership given the importance of these networks to people’s sense of identity. However, the rates of completion of the relevant question were high and the interviewers were trained and experienced. 3. The numerical size of each *biraderi* in the cohort varied – the largest was the Jatt (n = 552) and the smallest the Qasabi (n = 55). Population effects of any changes in marriage practices have to be considered with respect to these numbers; for example, the apparently distinct marriage preferences and practices of the Sheikh *biraderi* have been quite extensively cited, but this *biraderi* was represented by just 57 couples. 4. There also is the possibility of inaccuracy or bias in the data on consanguineous marriage, but in this case adverse publicity about consanguinity and genetic risk may lead to under-reporting. Again, the interviewers were trained and experienced and they had prompts at their disposal helping them to clarify what constituted blood relationships, e.g. what is a second cousin? Collecting questionnaire data and a family tree

provided some measure of verification of attribution, and there was considerable accord between the data collected by these two routes.

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Table 1 Prevalence of intra-*biraderi* marriage between mothers and fathers

	Mothers' <i>biraderi</i>	Fathers' <i>biraderi</i>	Matching parental <i>biraderi</i>
	N (%)	N (%)	N (%)
Jatt	552 (11.9)	555 (12.0)	506 (91.7)
Pathan	544 (11.8)	553 (11.9)	497 (91.4)
Rajput	523 (11.3)	507 (11.0)	421 (80.5)
Non- grouped	499 (10.8)	495 (10.7)	409 (82.0)
Choudhry	336 (7.3)	350 (7.6)	280 (83.3)
Bain	242 (5.2)	262 (5.7)	225 (93.0)
Kashmiri	219 (4.7)	203 (4.4)	164 (74.9)
Mughal	176 (3.8)	173 (3.7)	139 (79.0)
Syed	105 (2.3)	103 (2.2)	84 (80.0)
Malik	101 (2.2)	86 (1.9)	62 (61.4)
Gujjar	90 (1.9)	90 (1.9)	82 (91.1)
Quereshi	82 (1.8)	69 (1.5)	50 (61.0)
Awaan	77 (1.7)	78 (1.7)	63 (81.8)
Sheikh	57 (1.2)	52 (1.1)	36 (63.2)
Qasabi	55 (1.2)	53 (1.1)	44 (80.0)
Don't know/Did not wish to answer	487 (10.5)	574 (12.4)	
Missing	484 (10.5)	426 (9.2)	
Total	4,629 (100)	4,629(100)	

Table 2 Prevalence of Intra-*biraderi* marriage between mothers' parents and fathers' parents

	Mothers' mothers' <i>biraderi</i>	Mothers' fathers' <i>biraderi</i>	Matching <i>biraderi</i>	Fathers' mothers' <i>biraderi</i>	Fathers' fathers' <i>biraderi</i>	Matching <i>biraderi</i>
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Jatt	535 (11.6)	550 (11.9)	531 (99.3)	532 (11.5)	536 (11.6)	531 (99.8)
Pathan	540 (11.7)	545 (11.8)	518 (95.9)	542(11.7)	536 (11.6)	530 (97.8)
Rajput	519 (11.2)	524 (11.3)	491 (94.6)	500(10.8)	503 (10.9)	496 (99.2)
Non-grouped	516 (11.1)	513 (11.1)	484 (93.8)	474(10.2)	481 (10.4)	469 (98.9)
Choudhry	332 (7.2)	349 (7.5)	322 (97.0)	340 (7.3)	342 (7.4)	338 (99.4)
Bain	234 (5.1)	246 (5.3)	233 (99.6)	243 (5.2)	243 (5.2)	243 (100)
Kashmiri	224 (4.8)	211 (4.6)	201 (89.7)	218(4.7)	213 (4.6)	212 (97.2)
Mughal	183 (4.0)	185 (4.0)	171 (93.4)	176 (3.8)	181 (3.9)	175 (99.4)
Syed	104 (2.2)	104 (2.2)	97 (93.3)	98 (2.1)	103 (2.2)	98 (100)
Malik	88 (1.9)	93 (2.0)	81 (92.0)	80 (1.7)	85 (1.8)	78 (97.5)
Gujjar	90 (1.9)	91 (2.0)	86 (95.6)	92 (2.0)	91 (2.0)	91 (98.9)
Quereshi	80 (1.7)	86 (1.9)	69 (86.3)	81 (1.7)	82 (1.8)	79 (97.5)
Awaan	72 (1.6)	80 (1.7)	67 (93.1)	73 (1.6)	74 (1.6)	71 (97.3)
Sheikh	59 (1.3)	52 (1.1)	45 (76.3)	46 (1.0)	47 (1.0)	45 (97.8)
Qasabi	53 (1.1)	52 (1.1)	52 (98.1)	51 (1.1)	50 (1.1)	50 (98.0)
Don't know/Did not wish to answer	538 (11.6)	513 (11.1)		635 (13.7)	627 (13.5)	
Missing	462 (10.0)	435 (9.4)		448 (9.7)	435 (9.4)	
Total	4,629 (100)	4,629 (100)		4,629 (100)	4,629 (100)	

Table 3. Prevalence of intra-*biraderi* marriage between mothers' grandparents

	Maternal grandmothers' <i>biraderi</i>	Maternal grandfathers' <i>biraderi</i>	Matching <i>biraderi</i>	Paternal grandmothers' <i>biraderi</i>	Paternal grandfathers' <i>biraderi</i>	Matching <i>biraderi</i>
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Jatt	523 (11.3)	520 (11.2)	519 (99.2)	532 (11.5)	536 (11.6)	531 (99.8)
Pathan	524 (11.3)	532 (11.5)	516 (98.5)	542 (11.7)	536 (11.6)	530 (97.8)
Rajput	503 (10.9)	505 (10.9)	497 (98.8)	500 (10.8)	503 (10.9)	496 (99.2)
Non grouped	460 (9.9)	473 (10.2)	470 (99.4)	474 (10.2)	481 (10.4)	469 (98.9)
Choudhry	315 (6.8)	317 (6.8)	315 (100.0)	340 (7.3)	342 (7.4)	338 (99.4)
Bain	229 (4.9)	229 (4.9)	227 (99.1)	243 (5.2)	243 (5.2)	243 (100.0)
Kashmiri	221 (4.8)	221 (4.8)	218 (98.6)	218 (4.7)	213 (4.6)	212 (97.2)
Mughal	181 (3.9)	181 (3.9)	180 (99.4)	176 (3.8)	181 (3.9)	175 (99.4)
Syed	100 (2.2)	100 (2.2)	100 (100.0)	98 (2.1)	103 (2.2)	98 (100.0)
Malik	77 (1.7)	80 (1.7)	75 (97.4)	80 (1.7)	85 (1.8)	78 (97.5)
Gujjar	88 (1.9)	87 (1.9)	87 (98.9)	92 (2.0)	91 (2.0)	91 (98.9)
Quereshi	71 (1.5)	73 (1.6)	69 (97.2)	81 (1.7)	82(1.8)	79 (97.5)
Awaan	70 (1.5)	68 (1.5)	68 (97.1)	73 (1.6)	74 (1.6)	71 (97.3)
Sheikh	56 (1.2)	56 (1.2)	53 (94.6)	46 (1.0)	47 (1.0)	45 (97.8)
Qasabi	51 (1.1)	51 (1.1)	51 (100.0)	51 (1.1)	50 (1.1)	50 (98.0)
Don't know/Did not wish to answer	674 (14.6)	658 (14.2)		635	627 (13.5)	
Missing	486 (10.5)	478 (10.3)		448 (9.7)	435 (9.4)	
Total	4,629 (100)	4,629(100)		4,629 (100.0)	4,629 (100.0)	

Table 4 Consanguinity with mother and father in matching *biraderi*

Matching <i>biraderi</i>	Total	Consanguinity category					Don't know
		Unrelated ($F = 0$) N %	First cousin ($F = 0.0625$) N %	First cousin once removed ($F = 0.0313$) N %	Second cousin ($F = 0.0156$) N %	Other blood ($F < 0.0156$) N %	
Jatt	506	146 (28.9)	221 (43.7)	4 (0.8)	72 (14.2)	51 (10.1)	10 (2.0)
Pathan	497	188 (37.8)	204 (41.0)	2 (0.4)	68 (13.7)	33 (6.6)	1 (0.2)
Rajput	421	120 (28.5)	192 (45.6)	2 (0.5)	66 (15.7)	36 (8.6)	3 (0.7)
Choudhry	280	79 (28.2)	120 (42.9)	4 (1.4)	39 (13.9)	32 (11.4)	5 (1.8)
Bain	225	62 (27.6)	85 (37.8)	3 (1.3)	35 (15.6)	37 (16.4)	3 (1.3)
Kashmiri	164	55 (33.5)	53 (32.3)	1 (0.6)	31 (18.9)	21 (12.8)	3 (1.8)
Mughal	139	34 (24.5)	70 (50.4)	2 (1.4)	17 (12.2)	11 (7.9)	4 (2.9)
Syed	84	35 (41.7)	36 (42.9)	2 (2.4)	8 (9.5)	3 (3.6)	0 (0.0)
Malik	62	16 (25.8)	34 (54.8)	1 (1.6)	8 (12.9)	3 (4.8)	0 (0.0)
Gujjar	82	16 (19.5)	46 (56.1)	1 (1.2)	6 (7.3)	11 (13.4)	2 (2.4)
Quereshi	50	9 (18.0)	22 (44.0)	0 (0.0)	14 (28.0)	5 (10.0)	0 (0.0)
Awaan	63	11 (17.5)	38 (60.3)	0 (0.0)	6 (9.5)	7 (11.1)	1 (1.6)
Sheikh	36	16 (44.4)	12 (33.3)	1 (2.8)	5 (13.9)	1 (2.8)	1 (2.8)
Qasabi	44	12 (27.3)	23 (52.3)	0 (0.0)	5 (11.4)	4 (9.1)	0 (0.0)
Don't know/Did not wish to answer	454	200 (44.1)	161 (35.5)	0 (0.0)	50 (11.0)	50 (11.0)	10 (2.2)
Missing	371	273 (73.6)	2 (0.5)	2 (0.5)	25 (6.7)	11 (3.0)	3 (0.8)

Table 5 Intra-*biraderi* marriage and consanguinity

Born in Bradford participants	Intra- <i>biraderi</i> marriage	Parents in matching <i>biraderi</i> and consanguineous	Parents in matching <i>biraderi</i> and first cousins
Prevalence from high to low	<i>Over 90%</i>	<i>Over 80%</i>	<i>Over 60%</i>
	Bain	Awaan	Awaan
	Jatt	Quereshi	<i>Over 50%</i>
	Pathan	<i>Over 70%</i>	Gujjar
	Gujjar	Gujjar	Malik
	<i>Over 80%</i>	Malik	Qasabi
	Choudhry	Qasabi	Mughal
	Awaan	Mughal	<i>Over 40%</i>
	Rajput	Bain	Rajput
	Qasabi	Choudhry	Quereshi
	Syed	Rajput	Jatt
	<i>Over 70%</i>	Jatt	Choudhry
	Mughal	<i>Over 60%</i>	Syed
	Kashmiri	Kashmiri	Pathan
	<i>Over 60%</i>	Pathan	<i>Over 30%</i>
	Sheikh	<i>Over 50%</i>	Bain
	Malik	Syed	Sheikh
	Quereshi	Sheikh	Kashmiri